MISSOURI RIVER
PLENARY GROUP MEETING

NORTH DAKOTA FISH AND GAME
BISMARCK, ND
JUNE 29-30, 2005

General Meeting Summary

Use and Meaning of the 'Meeting Notes'. *Plenary and Technical Working Group meeting notes are intended to be a general summary of key issues raised and discussed by participants at meetings. The presentation of issues or items discussed is not designed to be totally comprehensive, or reflect the breadth or depth of discussions. It is intended to record the gist of conversations and conclusions. Where a consensus or other agreement was reached, it will be so noted. Where ideas are comments are from only one or several participants, or where a brainstormed list is presented the content of which was not agreed to by all group members, the recorders will to the best of their abilities note these qualifiers. When participants raise comments about the meeting notes, or make other suggestions or comments following meetings which are more than "corrections," we will add these in a section at the end of the meeting notes captioned "Post Script."*

This Meeting Summary is the independent work product of the mediation team from CDR Associates, an independent conflict management firm working under contract to the U.S. Institute for Environmental Conflict Resolution, which is serving in a neutral capacity to assist in the resolution of issues in an alternative dispute resolution process. Ideas developed or proposals discussed during deliberations by either the Plenary Group or Technical Working Group, or agreements on recommendations reached in either forum and recorded in Meeting Summaries are considered to be tentative and subject to review and/or approval by the leadership of participating federal, tribal and state agencies.

Opening and convening: The Plenary Group convened at 1:07 pm on June 29 and welcoming/opening remarks were offered by Col. Bedey (USACE), Robyn Thorsen (FWS) and Tex Hall (Three Affiliated Tribes).

Attendees: *See attachment A.*

Facilitators: Chris Moore, Mary Margaret Golten and Joe McMahon of the CDR Team.

Listing of Key Topics from Days 1 (June 29) and 2 (June 30), and Action or Results

Discussion Topic	Action or result
Day 1 (June 29)	
Plenary Group Protocols and Ground Rules, use of meeting notes, use of documents send out in draft format.	• Discussion of the limited changes on page 7 regarding use of documents or information. Members to review and make any necessary comment. • Meetings notes discussed as summaries and not detailed minutes. • To ensure accuracy, the CDR Team requested that documents send out for review not be distributed until made final by the CDR Team.
Update on Water Intake Issues.	Presentation and discussion by Col. Bedey. *See Attachment B.*
USGS Presentations on Historic Flow and Pallid Sturgeon.	Presentations by Robb Jacobson and David Galat; general discussion of what we know about the Pallid Sturgeon.
Presentation by Historic, Cultural and Burial Site Working Group.	
Amend Agenda for Day 2, adjourn.	
Day 2 (June 30)	
General comments from members of the Plenary	• Concern over how the Spring Rise fits into the broader recovery plan for the River; How to avoid a piecemeal approach to recovery. • More information and research on the Pallid Sturgeon is needed as well as effective monitoring.
Identification of any requests from Plenary to Cultural Historic and Burial Site.	Key issues include: • The Spring Rise process should not interfere with trust responsibilities to the Tribes. • Must closely watch effects on reservoir levels and exposure of cultural sites. • Consider canceling the Rise in 2006 due drought and effect on reservoirs.
Presentation from Hydrology and Water Quality Working Group.	Presentation by David Barfield and Jody Farhat (combined report from the Working Group and the USACE) *(See attachment B).* Key issues include:

Discussion Topic	Action or result
	• Peaks are better than plateaus. • If properly done, we can devise flexible windows of time for Rises. • Flood control constraints are very important to avoid unnecessary flooding. • Precludes need study – When should the Rise have a single peak or be cancelled?
Presentation from the Pallid Sturgeon Wildlife Working Group.	Presentation from Steve Krentz. Key issues include: • Large Rises are preferred but must be tempered by the other uses of water. • The best stimulus seems to be a two rise flow. • We need to make the Spring Rise and study the responses of the Pallid Sturgeon.
Public comment.	Completed, no comment received.
Report from the Socio Economic Working Group.	Key issues include: • In 2006, a single rise is preferred. • Peaks with steep rise and fall minimize adverse effects. • A delayed rise (July) seems to minimize adverse effects. • Monitoring is critical. • In some years, there should be no rise.
Discussion question #1: Where are we now? What is emerging? What concepts seem to merit the most attention?	Small and large group discussion; see notes below.
Discussion Question #2: What is missing from our discussion? What are our data needs?	Small and large group discussion; see notes below.
Discussion Question #3: If CNN, NPR, FoxNews etc., were broadcasting a story this August about our successful negotiations, what attitudes and qualities would they say brought success to this effort?	Small and large group discussion; see notes below.
Meeting Wrap up and Summary.	Completed.

Detailed Meeting Summary

Day 1 – June 29

Update on activities on **Tribal Water Intake**. Presentation by Col. Bedey. *See Attachment C*

USGS Presentations. Robb Jacobson and David Galat presented some update information on the historical hydrograph and Pallid Sturgeon spawning. *See Attachment D*

Presentation by Historic, Cultural and Burial Site Working Group

Presentation and discussion of key issues. The Group notes that it is a small group and its work to date is preliminary. Key points noted by this Group:

- Due to drought, we should consider canceling the Rise in 2006.
- We must look at both the overall effect and individual effects on each reservoir.
- This Spring Rise process should be managed so as not to interfere with the Trust responsibilities to the Tribes.
- Dropping reservoir levels may cause bank erosion and expose cultural sites; so detailed topographic information is needed about Spring Rise effects.
- Will Spring Rise mobilize sediments or pollutants in some areas – with an associated health threat?
- There should be a policy that human remains, if exposed, are presumed to be Native American unless shown otherwise.
- Tex Hall: Our history is critical to us and must be protected. We have strong values about the protection of fore bearers. The whole of the bottom lands was used by Tribes and cultural sites exist along it. The lower the water levels go, the more that is exposed.

Day 2 – June 30

Review of June 29 discussion. Completed.

Public comment. Completed, No comments received.

General comments from the Plenary. Within the Plenary, the following was mentioned:

- More information is needed to develop a broad plan for the restoration of the Pallid Sturgeon habitat, not just piecemeal approaches.
- More research is needed and ways to improve the total situation for River restoration– not just in one reach.
- We need data on the Spring Rise and impact on the Pallid Sturgeon – what are those links?

Cultural, Historical and Burial Site Working Group

What requests does the Plenary Group have for the Cultural, Historical and Burial Site Working Group? And what does the Cultural, Historical and Burial Site Group request?

- Post all applicable laws on Cultural, Historical and Burial Sites for the Plenary.
- Need data on how the Spring Rise will affect reservoir levels.

Hydrology Water Quality Working Group

Joint Report from USACE and Hydrology Water Quality Working Group from Jody Farhat and Dave Barfield.

The USACE part of this report focused on the modeling runs made by USACE using the Daily Routing model and more that 100 years of flow. The results are contained in the USACE report called "Spring Rise Alternative Analysis" (see USACE web site), and focuses on the impact of the three elements of the Spring Rise: early rise, mid-rise flow reduction and the second rise. The runs were done to look at a variety of Spring Rise options including single and double rises. Additional study was done to look at:

- Reservoir levels.
- Interior drainage (by looking at Nebraska City flows).
- Some parties have requested additional runs from the USACE.
- Information on Flood Control issues needs to be simplified.
- Is the spawning cue of 20% for 14 days a useful indicator?

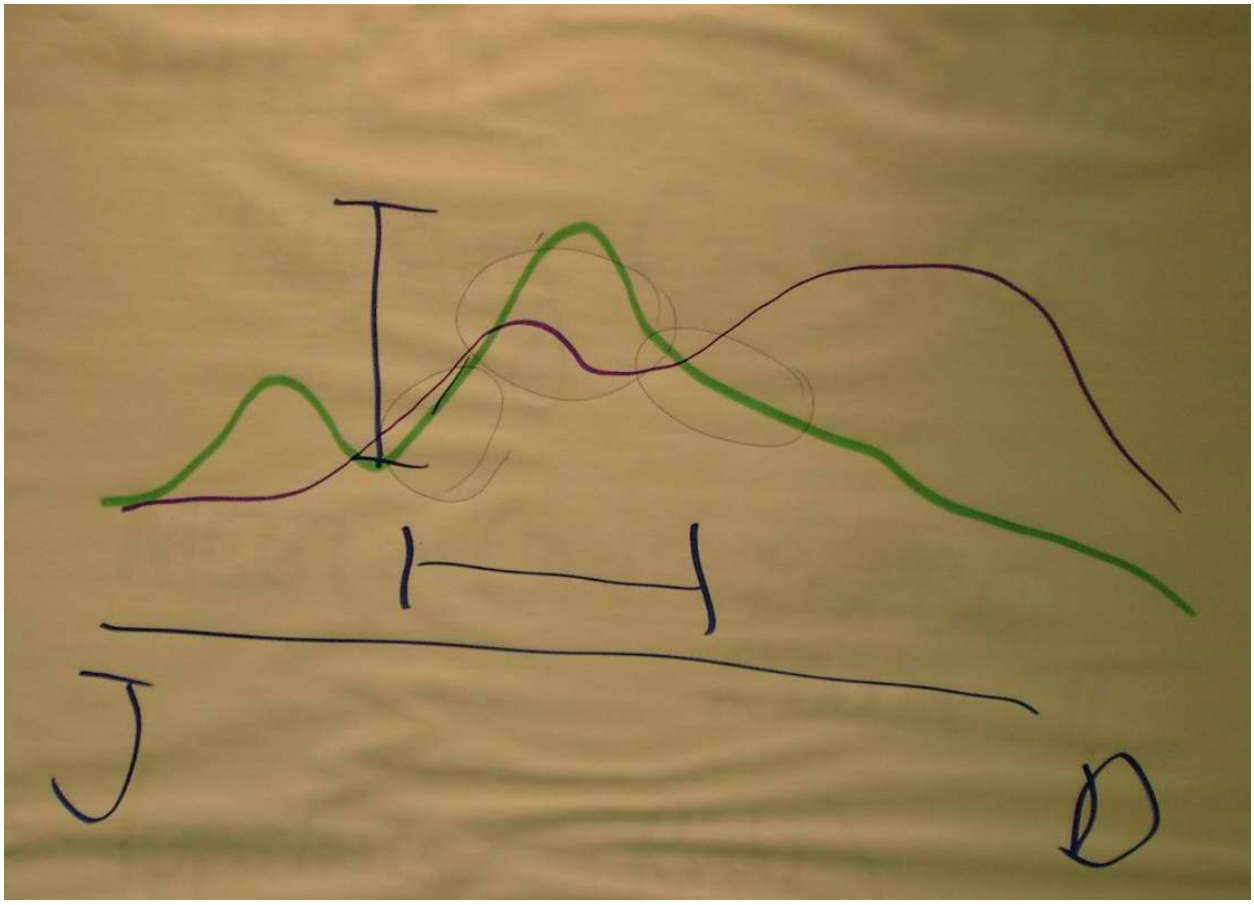
Some early conclusions appear as follows; the Spring Rise will reduce water levels in the reservoirs by a foot and current model (Daily Routing) was not able to make runs with peaks of less than 9 days

The Hydrology Water Quality Group has been working to find a range of alternative for the Plenary Group. The Group reports that a lot of energy was placed on the Second Rise. The Group reports:

- **Flood control constraints** – a complex issue for evaluation. The purpose is to reduce downstream flooding due to downstream/tributary flows. Higher constraints give more downstream protection but reduce the Spring Rise.
- **Precludes** - stops Spring Rise due to water availability. The Group has looked at a number of possible precludes including 31, 40, 46 and 50 MAF and the issue of proportioning the Spring Rise based on availability.
- **Peaks rather than plateaus** – this could save 40% of the water.
- **Flexible windows** – Can the parties give the USACE some times to work with and leave details to the USACE – this becomes an issue of trust.
- **Water neutrality** – who bears the effect of using the water? Is it the reservoirs, navigation or other factors?

See Attachment B for David Barfield and Jody Farhat presentations.

Pallid Sturgeon/FW Working Group Report to the Plenary
This Group presented a drawing of its favored hydrograph, that includes a stimulus with two peaks.



If there is response to the stimulus, they would then look at what needs to be adjusted and monitored. The Group:

- Prefers continuity rather than disruption of flow peaks – don't start and stop the rise.
- Will pull data on Pallid Sturgeon from other areas of the River
- Prefers a very large rise but recognizes the constraints on such due to other uses.
- Knows that flow, temperature and photoperiod are linked in some way.
- Has developed a number of hypotheses and will use these to identify monitoring needs.

Key discussion points:

- Monitoring is very important and needs to be funded.
- Some believe that a delay in the Spring Rise could be very helpful to water users.
- Water quality needs assessment due to the lack of turbidity and chemical elements in the reservoir releases.

Socio-Economic Working Group Report to the Plenary
This Group stated that it is monitoring the work of the other groups while it also gathers facts and opinions about how parties are affected. The Group did state that from their discussions:

- A single rise in 2006 is preferable.
- Steep rise and fall on Rises help reduce adverse effects.
- A delayed rise (July) may also reduce adverse effects.
- They suggest that ecosystem recovery should also be assessed from an economic viewpoint.
- There may be years where there should be no rise.
- Need to consider compensation to some landowners.
- The Spring Rise program needs a robust monitoring process so we know what has happened. The USACE model is not adequate to see the effects.

Three Questions to Small Groups of the Plenary and Reported to the Entire Plenary. .

Group Discussion Questions #1: **Where are we now in this process? What is emerging? What concepts seem to merit the most attention?** Although many issues were raised, we seem to think the following:

- Peaks are more desirable than plateaus.
    - How are the peaks attenuated as they move downstream?
    - Can we provide windows for the peaks that can be varied?
    - The use of peaks needs more study as it seems to be a favored option.
    - We may need to look at single peaks for certain years.
    - Pallid Sturgeon Group says timing is important.
    - Using peaks, we need to adjust for wet, dry and normal and water availability.
    - We need to modify the USACE model to run less than 9-day peaks.
- We need to give attention to "start stop protocols."
    - This topic has not yet had sufficient attention.
- There is a desire for a later timing for the Second Peak and a need for data on effect on the bird nesting.
- Research, monitoring and evaluation needs to be in place before the Spring Rise begins.
    - Need data for all key components: temperature, flow, photoperiod, dates, sedimentation, water quality.
- There is support for the use of flexible windows for the peaks, delegating final decisions to the USACE.
    - Trust needs to be built if USACE is to have flexibility in the use of windows of time.
- This is a long term process that needs long term commitment.
- Is the river reach below Gavins really the correct location?
    - In what other locations should this work be undertaken.
- Funding is needed for baseline data and ongoing monitoring and evaluation.
- On the process:

- Collaboration is better than litigation
- No matter what happens regarding the outcome, this process must continue up and down the River.
- Need greater transparency.
- We need to know sideboards on this process so we know how we are affected.
- We are under great time pressure.

2. Group Discussion Question #2: What seems to be missing from our discussions? Where do we need more data?

What is missing from our discussion?

- Elevation data so we can know what the cultural impact of the Rise is.
- The Plenary Group needs specific proposals now!
- There is a lot about the Pallid Sturgeon that we don't know.
- On tern and plover, will some windows work?
- We need several models for our next meeting! We need to start right away looking at models for evaluation-time is tight.
- We need to know what is acceptable and what is not.
- What are our goals in this process? 2006 or the long term or both?

3. Group Discussion Question #3: If CNN, NPR, FoxNews etc., were broadcasting a story this August about our successful negotiations, what attitudes and qualities would they say brought success to this effort?

We would succeed by:

- Acknowledging the threat of a USACE decision in any event – the "default." If we don't agree, the USACE will make a decision.
- Willingness of Agencies to listen to stakeholders.
- Broad stakeholder input.
- Being open-minded and using a fair process.
- A respectful, honest, transparent and diligent process.
- In spite of complexity, quality data was used with the help of technical groups.
- We acted in a different format than in the past.
- USGS added confidence to this process.
- A good mediation team.

Closing and adjournment.

- Short **story by Andy Mork** about Missouri River in the 1920's.
- Next Meeting in Omaha. The Plenary wants detailed presentations on options.
- Thanks from Col. Bedey for strong effort by all.

Attachment A – List of meeting attendees
Plenary Group Meeting
Bismarck, ND June 29-30, 2005

Members Listed in Capital Letters Attended the June 29-30 Meeting.

- **A.T. STAFNE**, ASSINIBOINE & SIOUX TRIBES OF FORT PECK
  - *Alternate:* Deb Madison
- **ANTOINE PROVOST**, OMAHA TRIBE OF NEBRASKA AND IOWA
  - *Alternate:* Ansley Griffin
- **BILL LAY**, MISSOURI LEVEE & DRAINAGE DISTRICT ASSOCIATION
- **BOB BACON,** COALITION TO PROTECT THE MISSOURI RIVER
- **Bob Riehl**, Western Area Power Administration
  - *ALTERNATE:* NICK STAS
- **BOONE WITMER,** UPPER BASIN BANK STABILIZATION
  - *ALTERNATE:* BUZZ MATTELIN
- **BRIAN BARELS**, NEBRASKA PUBLIC POWER DISTRICT
- **Chad Smith**, American Rivers
- **Charlie Scott**, U.S. Fish and Wildlife Service
  - *Alternate:* Mike Olson
- **DAN FUHRMAN,** MO-ARK
- **DARRELL DORSEY,** KANSAS CITY BOARD OF PUBLIC UTILITIES
- **DAVE NELSON**, CHEYENNE RIVER SIOUX TRIBE
  - *Alternate:* Bob Walters
  - REBECCA KIDDER
- **DAVID MURPHY,** CONSERVATION FEDERATION OF MISSOURI
- **DON JORGENSON**, MISSOURI RIVER TECHNICAL GROUP
- **Donald "Bucky" Pilcher**, Sac & Fox Nation of Missouri in Kansas and Nebraska
- **FELIX KITTO**, SANTEE SIOUX TRIBE
- **GENE ZUERLEIN**, NEBRASKA (GAME & PARKS)
- **GEORGE CUNNINGHAM,** SIERRA CLUB
- **HERB GRENZ**, UPPER BASIN IRRIGATION
  - *ALTERNATE:* DAVE JOHNSON, GARRISON DIVERSION CONSERVANCY DISTRICT

- **HOWARD PAUL,** MISSOURI RIVER SEDIMENTATION
- **JASON SKOLD**, THE NATURE CONSERVANCY
- **JIM BERKLEY**, ENVIRONMENTAL PROTECTION AGENCY
    - *Alternates:* Gale Hutton
    - JOE COTHERN
- **Jim Dinsmore**, IA Audubon
- **JIM PETERSON**, MISSOURI RIVER BANK STABILIZATION ASSOCIATION
- **Jim Stone, Jr.**, Yankton Sioux Tribe
    - *Alternate:* Cliff Johnson
- **JOSEPH SMITH**, STANDING ROCK SIOUX TRIBE
- **LANNY MENG**, MISSOURI RIVER LEVEE & DRAINAGE DISTRICT ASSOCIATION
- **Larry Foster**, Omaha Municipalities
    - *Alternate:* Skip Meisner
- **LEROY "LEE" KLOPPRODT,** NORTH DAKOTA SPORTFISHING CONGRESS
- **LYNN MUENCH**, THE AMERICAN WATERWAYS OPERATORS
    - *Alternate:* Kevin Nepper
- **Mike McGhee**, Iowa
    - *ALTERNATES:* HAROLD HOMMES
    - John Hey
- **MIKE WELLS**, MISSOURI
    - *ALTERNATE:* DENISE GARNIER
- **ROSE HARGRAVE**, UNITED STATES ARMY CORPS OF ENGINEERS
    - *ALTERNATE:* MARY ROTH
- **Scott Jones**, Lower Brule Sioux Tribe
- **Steve Adams**, Kansas
    - *ALTERNATE:* DAVE BARFIELD
- **SUE JENNINGS**, NATIONAL PARK SERVICE
    - *Alternate: W*ayne Werkmeister
- **Sue Lowry**, Wyoming
    - *Alternate:* Jodee Pring
- **TEX HALL**, THREE AFFILIATED TRIBES OF FORT BERTHOLD
    - Alternate: Steve Kelly
    - Paul Danks

- **TODD SANDO,** NORTH DAKOTA
- **TOM GRAVES**, MID-WEST ELECTRIC CONSUMERS ASSOCIATION
    - *Alternate:* Lee Nelson
- **Tom Schrempp**, Water One
- **Tom Huntley**, Central Montana Electric Power Cooperative
- **TROY BREDENKAMP,** AMERICAN FARM BUREAU ASSOCIATION
    - *Alternates:* Dan Cassidy
    - Garrett Hawkins
- **WALT MORAN**, TRENTON INDIAN SERVICE AREA
    - *ALTERNATE:* ALFRED SLATER, TRENTON INDIAN SERVICE AREA
- **Wayne Nelson-Stastny,** South Dakota (DGF&P)
    - *Alternates:* Garland Erbele
    - Mark Rath
- **WILLIAM BEACOM**, PASSENGER VESSEL ASSOCIATION
- TBD, Crow Creek Sioux Tribe
- TBD, Montana
    - *ALTERNATE:* TIM BRYGGMAN
- TBD, Sisseton-Wahpeton Oyate
- TBD, Upper Basin Recreation

Observers

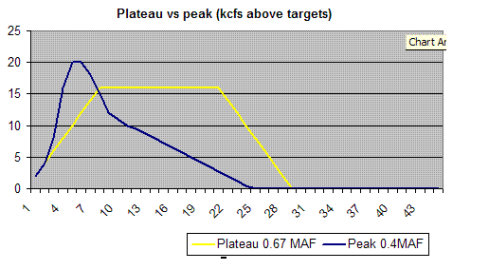
Bill Bryan
Bill Wiedenheft
Byron Asa
Cary Fourstar
Darwin Snyder
Dawnette Owens
Dick Messerly
Doug moss
Doug Mund
Jane Ledwin
Jody Farhat
Joe Gibbs
Joel Ames
Jonathan Bry
Karen Rouse
Ken Rorse
Kip Hurley
Mike Collins
Paul Gross
Pemina Yellow Bird
Ralph Walker
Randy Bailey
Rhonda Azure
Rick Inglis
Roger Collins
Ronald Sando
Sandra Keo
Shirley Rouillard
Terry Fleck
Tracy Hill
Tyler Cole
Vic Simmons

Attachment B
Hydrology and Water Quality Working Group Presentations
By David Barfield and Jody Farhat

Hydrology/WQ Tech group

- Minneapolis meeting
- Two conference calls since Minneapolis
- Reviewed Corps report on the runs
- Discussions here

Spring rise



Flood control constraints

- Complex
- Corps uses FC constraints to inform it when to cut releases due to downstream flows.
- FC are related to the navigation service level being provided.
- The Corps runs includes a 16 kcfs increase to FC constraints during the second rise, and 3 lesser levels of increase.

Impact of Flood Control Constraints on Minimum System Storage During Droughts

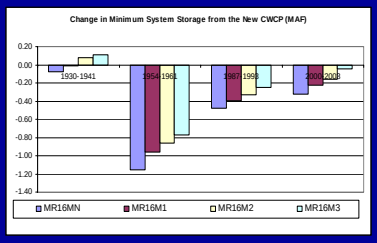


Figure 3

- Comparison is to the current water control plan
- Raising the flood control constraints the full amount of the spring rise uses the most water because it allows the spring rise to be run in many years
- As flood control constraints are reduced, the spring rise gets shuts off more frequently resulting in less water used

Impact of Flood Control Constraints on Spawning Cue

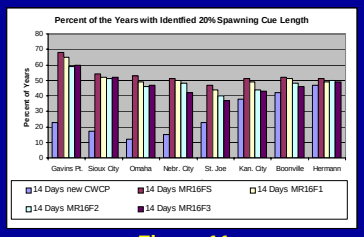


Figure 11

- Number of years meeting spawning cue criteria is generally reduced as flood control constraints become more restrictive
- Difference between alternatives ranges from 2 to 10 percent of years
- All alternatives meet spawning cue criteria more than 35 percent of the years at all locations

Flood constraint conclusion

- We should continue to examine the flood control constraints as it appears possible to reduce risk to downstream users, conserve storage, and achieve a spawning cue through careful selection of the specifics.
- Question: is the Corps definition of spawning cue appropriate?

Spring Rise preclude and/or proportioning the spring rise

- The Corps has modeled
  - a range of precludes (31, 40, 46, and 50 MAF) to discontinue the SR during drought
  - proportioning the spring rise based on system storage during drought.
- The Hydrology group has not yet fully discussed the results. We need runs that directly compare precludes and proportioning the SR.

Impact of the Spring Rise Preclude on Minimum System Storage During Droughts

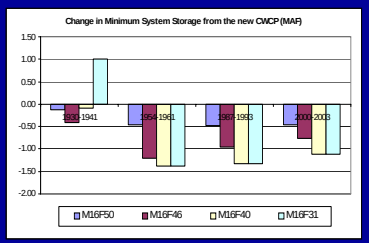
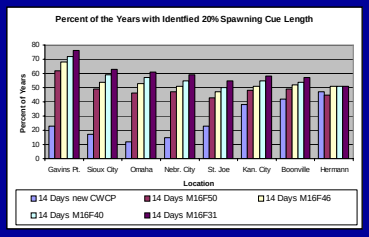


Figure 4

- Comparison is to the current water control plan
- In general, as the spring rise preclude is lowered, system storage during the droughts is lowered due to the ability to run spring rises in more years
- In the 30's drought, the order of non-navigation years changed and an additional non-navigation year was added with the 31 MAF preclude
- In the other 3 droughts, system storage didn't fall below 40 MAF, so the 31 and 40 MAF runs are the same

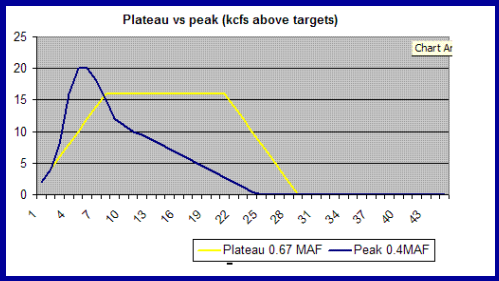
Impact of the Spring Rise Preclude on Spawning Cue



- Number of years meeting spawning cue criteria increases as the spring rise preclude is reduced
- Maximum difference is 11 percent of years
- All alternatives meet spawning cue criteria more than 40 percent of the years at all locations

Figure 12

Spring rise peak vs plateau



- Likely to conserve water
- Reduce time at the peak

Other considerations

- Corps flexibility – Can we give the Corps spring rise constraints (window of dates, peak flow requirements, duration or slopes of rise/fall, etc) and allow them to choose when to do it to take advantage of the year's events and reducing risks downstream?
- Just because we cannot model it, doesn't meet we can't do it.

Questions to the Pallid Sturgeon group

- Is the Corps' measure of the "spawning cue" an acceptable measure? If not, what is?
- Plateau vs. peak. What should be used? What rate of rise and rate of fall?
- Can the date of the spring rise be put off to help the spawns in the reservoirs? How does temperature fit on the SR date? Is it just as significant to the lower reach as the upper reach?
- Prioritization of the spring rise elements would be very helpful.

More questions

- “Water neutrality”. Who pays for the spring rise?
- Impacts to the Mississippi River. How significant?

Today’s work and beyond

- Continuing to look at the current model runs and generating additional runs based on what we are learning.
- Elements could include:
  - Most restrictive flood control constraints consistent with recovery.
  - Identify when to have no rise, one rise, two rises based on system storage OR shall we use proportioning of the rise based on system storage.
  - If going to use a peak (as opposed to a plateau), what parameters?
  - Identify window for the spring rise based on temperature, other

U.S. Army Corps of Engineers
Northwestern Division

Missouri River Basin Water Management

Spring Rise Alternatives
2nd Technical Group Mtg.
Bismarck, ND

June 28, 2005

Presentation Topics
Spring Rise Alternatives Summary

- Summary of alternatives modeled to date for the Spring Rise
- Summary of the effects of various plan components/criteria on system storage, lower river flows, and spawning cues
- Similar data as above for special runs

2

Plan Components Analyzed

- First Rise
  - None, 31 kcfs, navigation flow + 5 kcfs
- April Flows between the Rises
  - Minimum service, alternative guide curve, current guide curve
- Second Rise
  - Maximum release = 16 kcfs, duration = 2 weeks
  - Proration based on system storage
  - Spring rise preclude
  - Adjustment of flood control constraints

3

Effects Analyzed

- Minimum System Storage during Historic Droughts
- Flows at Nebraska City
- Economic Uses, Environmental Resources and Historic Properties
- Spawning Cue

4

Analysis to Determine Trends Associated with Various Components of the Spring Rise Hydrograph

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Table 2

Table 2. Alternatives Formulated from Table 1 Requirements

Alternative Name	First Rise		Drop Between Rises			Max Rise	FC Constraints		Max or Prorate during drought	
	None	Nav +5 1 Wk	Min Serv	New GC	Current GC	16 kcfs 2 wk pk	Plus 16	Min. Raise	Max w/ Precl.	Prorate w/ Precl.
Existing runs										
MR16FS									46 MAF	
F1 and F2 lie between MR16F3									46 MAF	
MR16MN									46 MAF	
M1 and M2 lie between MR16M3									46 MAF	
M16F50									50 MAF	
M16F40									40 MAF	
M16F31									31 MAF	
MRBIO3		31 kcfs							46 MAF	
MRBIO4		31 kcfs								31 MAF
MRBIO5										31 MAF
N at end indicates no first rise MBIO53										31 MAF
Special Criteria Identified by the Hydrologic Work Group										
MRBP52 - MRBIO5 w/ shorter 2nd Rise						16 kcfs w/ < 2 wk peak				31 MAF
BIO521 - MRBP52 with 21 kcfs max						21 kcfs w/ < 2wk peak				31 MAF
BIO518 - MRBIO5 with 18 kcfs April			< MS							31 MAF

Table 2 (Revised)

Alternative Name	First Rise		Drop Between Rises			Max Rise	FC Constraints		Max or Prorate during drought	
	None	Nav +5 1 Wk	Min Serv	New GC	Current GC	16 kcfs 2 wk pk	Plus 16	Min. Raise	Max w/ Precl.	Prorate w/ Precl.
Existing runs										
MR16FS									46 MAF	
F1 & F2 lie between MR16F3									46 MAF	
MR16MN									46 MAF	
M1 and M2 lie between MR16M3									46 MAF	
M16F50									50 MAF	
M16F40									40 MAF	
M16F31									31 MAF	
MRBIO4		31 kcfs								31 MAF
MRBIO3		31 kcfs							46 MAF	
New Runs MRBIO5										31 MAF
MRBI5N										31 MAF
MBIO53										31 MAF
MBI53N										31 MAF
MRBP32 - MRBIO3 w/shorter 2nd rise		31 kcfs				16 kcfs w/< 2 wk peak			46 MAF	
MRBP52 - MRBIO5 w/shorter 2nd rise						16 kcfs w/< 2 wk peak				31 MAF
BIO521 - MRBP52 with 21 kcfs max						21 kcfs w/< 2 wk peak				31 MAF
BIO518 - Run with 18 kcfs April	not done									
BIO500 - only first	not done									
JS Run with 2nd Rise begin July 1										

Impacts on Minimum System Storage During Droughts

8

Impact of First Rise on Minimum System Storage During Droughts

- Looked at two spring rise plans – with and without the first spring rise

Alternative Name	First Rise		Drop Between Rises			Max Rise	FC Constraints		Max or Prorate during drought	
	None	Nav +5 1 Wk	Min Serv	New GC	Current GC	16 kcfs 2 wk pk	Plus 16	Min. Raise	Max w/ Precl.	Prorate w/ Precl.
MRBIO5										31 MAF
MRBI5N										31 MAF
MBIO53										31 MAF
MBI53N										31 MAF

- Compared the difference in minimum system storage in each major drought

9

Impact of First Rise on Minimum System Storage During Droughts

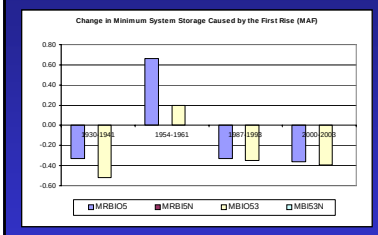


Figure 1

- First spring rise generally reduced the minimum storage during droughts
- Impact during droughts was less than 1 foot in each of the upper three reservoirs
- At full conservation pools, 830 kaf = 1 foot
- At current levels, 560 kaf = 1 foot

10

Impact of April Flows on Minimum System Storage During Droughts

- Looked at three spring rise plans – with differing April flows
  - Minimum Service
  - Alternative Guide Curve
  - Current Guide Curve

Alternative Name	First Rise		Drop Between Rises			Max Rise	FC Constraints		Max or Prorate during drought	
	None	Nav +5 1 Wk	Min Serv	New GC	Current GC	16 kcfs 2 wk pk	Plus 16	Min. Raise	Max w/ Precl.	Prorate w/ Precl.
MR16F3									46 MAF	
MR16M3									46 MAF	
MBI53N										31 MAF

- Compared minimum system storage in each major drought

11

Impact of April Flows on Minimum System Storage During Droughts

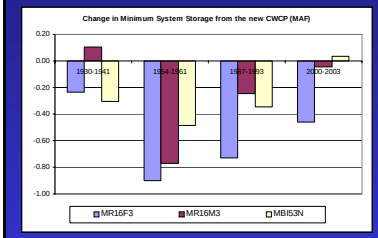


Figure 2

- Comparison is to the current water control plan
- Running minimum service in April uses less water than the current guide curve
- The alternative guide curve also appears to use less water, but some of the impact is likely due to the prorated second spring rise
- Difference between spring rise alternatives was generally less than 1 foot in each of the upper three reservoirs

12

Impact of Flood Control Constraints on Minimum System Storage During Droughts

- Looked at four spring rise plans – with varying adjustments to the flood control constraints

Alternative Name	First Rise		Drop Between Rises			Max Rise	FC Constraints		Max or Prorate during drought	
	None	Nav +5 1 Wk	Min Serv	New GC	Current GC	16 kcfs 2 wk pk	Plus 16	Min. Raise	Max w/ Precl.	Prorate w/ Precl.
MR16MN									46 MAF	
M1 and M2 lie betweeen									46 MAF	
MR16M3									46 MAF	

- Compared minimum system storage in each major drought

Impact of Flood Control Constraints on Minimum System Storage During Droughts

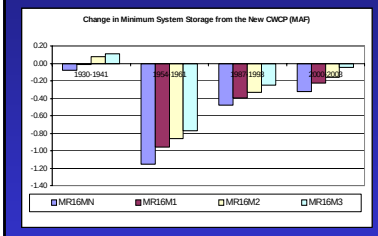


Figure 3

- Comparison is to the current water control plan
- Raising the flood control constraints the full amount of the spring rise uses the most water because it allows the spring rise to be run in many years
- As flood control constraints are reduced, the spring rise gets shuts off more frequently resulting in less water used

Impact of the Spring Rise Preclude on Minimum System Storage During Droughts

- Looked at four spring rise plans – with Spring Rise precludes ranging from 31 to 50 MAF

Alternative Name	First Rise		Drop Between Rises			Max Rise	FC Constraints		Max or Prorate during drought	
	None	Nav +5 1 Wk	Min Serv	New GC	Current GC	16 kcfs 2 wk pk	Plus 16	Min. Raise	Max w/ Precl.	Prorate w/ Precl.
M16F50									50 MAF	
MR16F46 (MR16FS)									46 MAF	
M16F40									40 MAF	
M16F31									31 MAF	

- Compared minimum system storage in each major drought

Impact of the Spring Rise Preclude on Minimum System Storage During Droughts

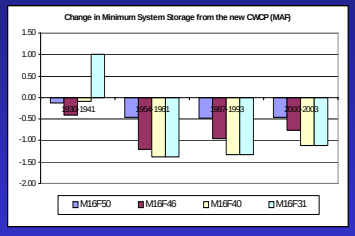


Figure 4

- Comparison is to the current water control plan
- In general, as the spring rise preclude is lowered, system storage during the droughts is lowered due to the ability to run spring rises in more years
- In the 30's drought, the order of non-navigation years changed and an additional non-navigation year was added with the 31 MAF preclude
- In the other 3 droughts, system storage didn't fall below 40 MAF, so the 31 and 40 MAF runs are the same

Impacts on

Flows at Nebraska City

during May and June

17

Impact of April Flows on Flows at Nebraska City

- Looked at the current water control plan and three spring rise plans with differing April flows
  - Minimum Service
  - Alternative Guide Curve
  - Current Guide Curve
- Full increases in flood control constraints

Alternative Name	First Rise		Drop Between Rises			Max Rise	FC Constraints		Max or Prorate during drought	
	None	Nav +5 1 Wk	Min Serv	New GC	Current GC	16 kcfs 2 wk pk	Plus 16	Min. Raise	Max w/ Precl.	Prorate w/ Precl.
CWCP										
MR16FS									46 MAF	
MR16MN									46 MAF	
MRBIO5										31 MAF

- Compared the number of days flow would exceed 55 kcfs at Nebraska City

18

Impact of April Flows on Flows at Nebraska City

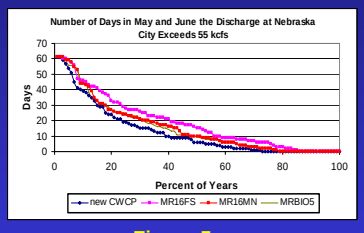


Figure 5

- All spring rise alternatives increase the number of days flow is above 55 kcfs
- Running minimum service between the rises reduces this effect
- Second spring rise is added to existing flow; therefore, the lower the existing flow, the lower the spring rise
- MRBIO5 has prorated spring rise so isn't directly comparable
- Full increases in flood control constraints

19

Impact of April Flows on Flows at Nebraska City

- Looked at the current water control plan and three spring rise plans with differing April flows
  - Minimum Service
  - Alternative Guide Curve
  - Current Guide Curve
- Minimum increases in flood control constraints

Alternative Name	First Rise		Drop Between Rises			Max Rise	FC Constraints		Max or Prorate during drought	
	None	Nav +5 1 Wk	Min Serv	New GC	Current GC	16 kcfs 2 wk pk	Plus 16	Min. Raise	Max w/ Precl.	Prorate w/ Precl.
CWCP										
MR16F3									46 MAF	
MR16M3									46 MAF	
MBI53N										31 MAF

- Compared the number of days flow would exceed 55 kcfs at Nebraska City

20

Impact of April Flows on Flows at Nebraska City

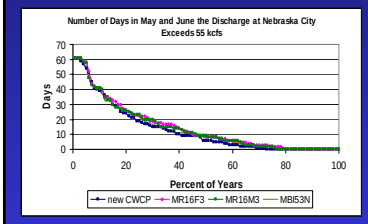


Figure 6

- All spring rise alternatives increase the number of days flow is above 55 kcfs
- Reducing the flood control constraints reduces the difference between the alternatives
- Running minimum service between the rises still reduces the number of days with flow above 55 kcfs
- MBI53N has prorated spring rise so isn't directly comparable

Impacts on Average Annual Economic Uses, Environmental Resources, and Historic Properties

Table 4. Economic use and environmental resource impacts of the spring rise alternatives.

	Impacts 1938-1997															
Alt Name																
1997-2006		FLD CON	NAVIG	HYDRO	WTR SUP	RECR	TOT NED	YOY	CLD RES	COLD RIV	WRM RIV	PHY HAB	TBP HAB	WET HAB	RIP HAB	RSPRGP
NWCP00	M CP300	430.2	9.35	674.3	613	87.4	1792.5	2.33	10.3	165.9	50.4	81.4	304.9	157.6	87.8	4905
MRBX0X	M RBX0X	407.6	7.35	672.7	607.7	86.6	1783.9	2.32	10.1	165.6	49.6	82.5	293.9	157.0	86.3	4856
MRBF3S	M RB0S	408.1	8.47	672.0	607.6	86.4	1782.4	2.32	10.0	165.0	48.8	82.6	298.7	155.7	85.6	5025
MRBF1	M RB01	407.9	8.54	672.3	607.7	86.5	1783.0	2.32	10.0	164.7	49.3	82.5	297.2	154.4	85.9	5017
MRBF2	M RB02	408.1	8.54	672.6	53.2	86.4	1785.8	2.33	10.0	164.7	48.8	82.4	295.8	154.6	85.1	5038
MRBF3	M RB03	407.9	8.55	673.0	607.9	86.4	1783.7	2.32	10.0	164.9	49.3	82.3	2510	153.1	85.9	5003
M BF50	M B050	408.1	8.25	672.6	607.8	86.6	1783.4	2.33	10.0	164.8	49.2	82.5	295.6	155.9	85.6	5006
M BF46	M B0S	408.1	8.47	672.0	607.6	86.4	1782.4	2.32	10.0	165.0	48.8	82.6	298.7	155.7	85.6	5025
M BF45	M B045	408.1	8.72	671.6	53.9	86.6	1785.9	2.32	9.9	164.4	49.3	82.7	299.9	157.2	85.4	5045
M BF31	M B031	408.1	8.80	671.8	630.6	87.1	1786.3	2.33	10.0	164.7	48.9	82.6	316.5	156.8	85.0	5043
MRBMN	M RBN	407.6	8.37	674.2	608.0	86.9	1785.1	2.34	10.1	166.9	48.4	82.9	277.6	156.4	87.6	4923
MRBM1	M RB1	407.6	8.37	674.5	614.4	86.8	1788.7	2.35	10.2	167.8	47.8	83.0	280.6	154.6	88.1	4927
MRBM2	M RB02	407.5	8.33	674.8	614.4	86.9	1788.9	2.36	10.2	167.5	47.8	83.0	272.0	153.8	88.6	4921
MRBM3	M RB03	407.5	8.35	674.9	617	86.9	1789.4	2.36	10.3	167.3	48.3	83.0	277.6	155.1	87.5	4897
1997-2006																
MRBX04	M JB04	407.3	9.5	673.6	607.3	86.3	1784.0	2.35	10.2	166.9	47.8	82.1	293.9	157.3	86.3	4941
MRBX05	M JB05	405.9	10.3	673.1	607.3	86.2	1782.8	2.35	10.1	166.6	48.4	82.1	281.8	156.3	87.0	4964
MRBX53	M JX53	407.3	10.3	673.9	607.4	86.8	1785.7	2.37	10.2	166.9	48.2	83.0	284.7	154.9	87.9	4933
MRBF52	M JB52	407.2	9.8	673.4	607.2	86.3	1784.0	2.35	10.1	166.4	48.8	82.1	305.3	157.9	87.0	4902
BJO521	B JO521	407.5	9.5	672.8	630.8	87.5	1788.2	2.35	10.1	165.1	48.7	82.2	297.6	157.5	86.4	5021
MRBSN	M JB5N	405.7	10.3	673.0	607.4	86.8	1784.0	2.36	10.2	166.4	48.7	82.0	305.4	156.1	85.6	4924
MRB2N	M JX2N	405.5	9.7	674.7	614	87.0	1788.4	2.37	10.3	166.7	47.8	83.0	310.7	154.5	87.4	4897
	Percent Change From the Value for the NWCP (MCP300 Run)															
	MRBX0X	-1	-23	0	-1	-1	-1	1	-1	0	-4	1	-7	0	-1	1
	MRB0S	-1	-9	0	-1	-1	-1	0	-3	0	-3	1	-2	-1	-2	2
	MRB01	-1	-9	0	-1	-1	-1	0	-3	-1	-2	1	-8	-2	-2	2
	MRB02	-1	-9	0	0	-1	0	0	-3	-1	-3	1	-10	-2	-2	2
	MRB03	-1	-7	0	-1	-1	0	0	-2	-1	-2	1	-7	-3	-1	2
	M B050	0	-32	0	-1	-1	-1	0	-2	-1	-3	1	-3	-1	-2	2
	M B05	-1	-9	0	-1	-1	-1	0	-3	0	-3	1	-2	-1	-2	2
	M B040	-1	-7	0	0	-1	0	-1	-3	-1	-2	2	-2	0	-2	3
	M B031	-1	-7	0	0	0	0	0	-3	-1	-3	2	4	1	-3	3
	M RBN	-1	-10	0	-1	-1	0	0	-1	1	-4	1	-9	-1	0	1
	M RB1	-1	-9	0	0	-1	0	1	-1	1	-7	1	-8	-2	0	0
	M RB2	-1	-9	0	0	0	0	1	-1	1	-5	1	-10	-2	1	0
	M RB3	-1	-9	0	0	0	0	1	0	1	-4	0	-9	-2	0	0
	M JB04	-1	1	0	-1	-1	0	1	-1	1	-5	1	-4	0	-1	1
	M JB05	-1	10	0	-1	-1	-1	1	-2	0	-4	1	-8	0	-1	1
	M JX53	-1	10	0	-1	-1	0	2	-1	1	-4	1	-7	-2	0	1
	M JB52	-1	5	0	-1	-1	0	1	-2	0	-3	1	0	0	-1	1
	BJO521	-1	2	0	0	0	0	1	-2	0	-3	1	-2	0	-1	2
	M JB5N	-1	10	0	-1	-1	0	1	-2	0	-3	1	-7	0	-1	0
	M JX2N	-1	4	0	0	0	0	2	0	0	-5	0	-2	-2	0	0

Comments on Summary of Uses

- Percent changes for all categories except navigation and tern and plover habitat are relatively constant, and are generally in the range of +/–2 percent
- Navigation data for spring rise runs is flawed. Time constraints have not permitted the required hand corrections to the raw data files from the hydrologic model
- Tern and plover habitat results are based on habitat available in the early 1990's and are not representative of the habitat available today

Impacts on

Spawning Cues

25

Indicators of Spawning Cue

- Master Manual EIS used a flow/duration combination as a surrogate for spawning cue
  - 20 percent increase of flow
  - 14 days duration
- Other combinations of magnitude and duration could be used
- Actual spawning cue is likely a combination of many factors such as flow, stage, temperature, photoperiod, etc

26

Indicators of Spawning Cue

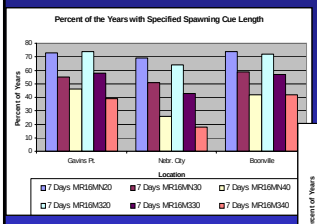


Figure 8

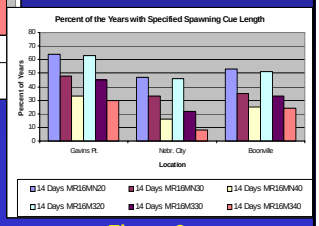


Figure 9

27

Impact of April Flows on Spawning Cue

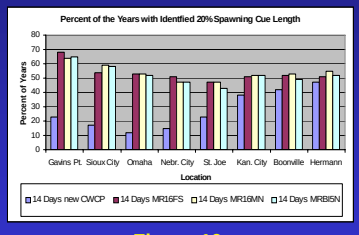


Figure 10

- Higher April flows result in higher magnitude of spring rises, but not necessarily more years with a 20 percent increase in flows
- Relatively little difference between alternatives
- All alternatives meet spawning cue criteria more than 40 percent of the years at all locations

28

Impact of Flood Control Constraints on Spawning Cue

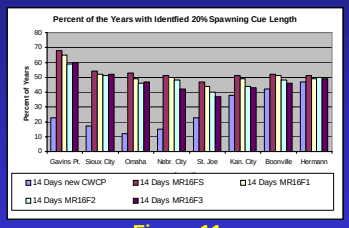


Figure 11

- Number of years meeting spawning cue criteria is generally reduced as flood control constraints become more restrictive
- Difference between alternatives ranges from 2 to 10 percent of years
- All alternatives meet spawning cue criteria more than 35 percent of the years at all locations

Impact of the Spring Rise Preclude on Spawning Cue

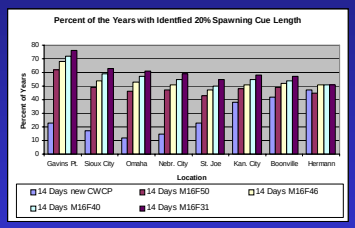


Figure 12

- Number of years meeting spawning cue criteria increases as the spring rise preclude is reduced
- Maximum difference is 11 percent of years
- All alternatives meet spawning cue criteria more than 40 percent of the years at all locations

Analysis of Special Runs Requested by Technical Working Group

Special Runs Requested by the Technical Working Group

- Requests received for several additional runs
  - ✓ Shorter duration of second rise
    - ➢ *Duration of the spring rise could not be reduced to less than 9 days due to modeling limitations – this is not a limit in real time regulation*
  - ✓ Greater magnitude of second rise (+21 kcfs)
  - First rise followed by 18 kcfs in April
  - No first rise; winter releases until May 1
  - First rise only
  - Second rise beginning on July 1

Special Runs Requested by the Technical Working Group

- Alternatives used in Special Run Comparisons

Alternative Name	First Rise		Drop Between Rises			Max Rise	FC Constraints		Max or Prorate during drought	
	None	Nav +5 1 Wk	Min Serv	New GC	Current GC	16 kcfs 2 wk pk	Plus 16	Min. Raise	Max w/ Precl.	Prorate w/ Precl.
CWCP										
MBIO53										31 MAF
MRBP52 - MRBIO5 w/shorter 2nd rise						16 kcfs w/< 2 wk peak				31 MAF
BIO521 - MRBP52 with 21 kcfs max						21 kcfs w/< 2 wk peak				31 MAF

- Compared the difference in minimum system storage in each major drought
- Compared the number of days flow would exceed 55 kcfs at Nebraska City
- Compared the impact on spawning cue

Impact of Special Runs on Minimum System Storage During Droughts

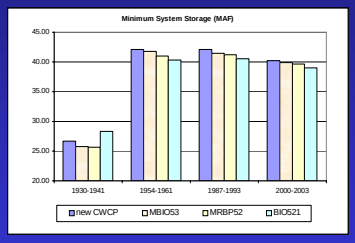


Figure 18

- MBIO53 has different flood control constraints so isn't directly comparable
- Alternatives generally result in lower system storages during droughts than the CWCP
- The higher spring rise (21 kcfs) reduces system storage in 3 of the 4 droughts

Impact of Special Runs on Flows at Nebraska City

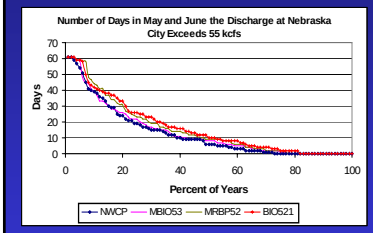


Figure 19

- MBIO53 has different flood control constraints so isn't directly comparable
- All spring rise alternatives increase the number of days flow is above 55 kcfs
- The higher spring rise (21 kcfs) increases the number of days the flow is above 55 kcfs

Impact of Special Runs on Spawning Cue

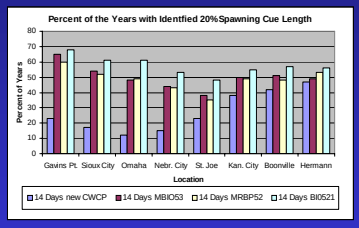
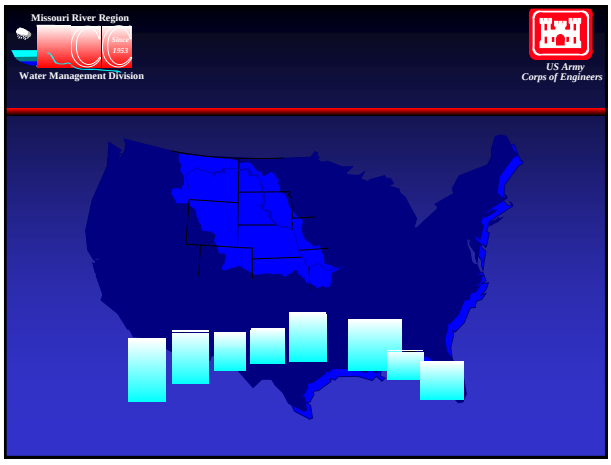
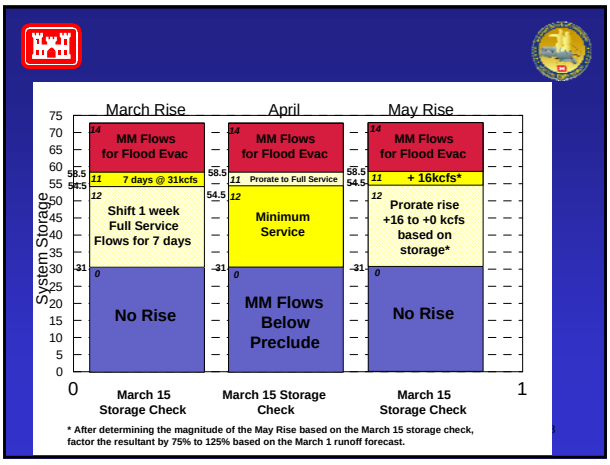


Figure 20

- Spawning cue criteria used was 20 percent increase in flow for 14 days
- All spring rise alternatives increase the percent of years meeting the spawning cue criteria
- The higher spring rise (21 kcfs) increases the percent of years that meet the spring rise criteria
- All alternatives meet spawning cue criteria more than 35 percent of the years at all locations





3 – Second Bimodal Spring Rise

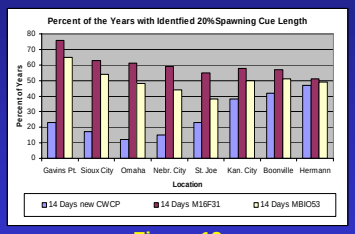
Volume of Water Needed for a Full Spring Rise (million acre-feet)

Spring Rise Amount (kcfs)	Weeks at Peak Rise 2	3	4
4	0.167	0.222	0.278
8	0.333	0.444	0.555
12	0.500	0.666	0.833
16	0.666	0.889	1.111
20	0.833	1.111	1.388

40

41

Combined Impact of Spring Rise Components on Spawning Cue



- Both alternatives meet spawning cue criteria more than 35 percent of the years at all locations
- Maximum difference at St Joseph (17 percent of years)
- Minimum difference at Hermann (2 percent of years)

Figure 13

- M16F31
  - No first rise
  - Current April guide curves
  - +16 flood control constraints
  - 31 MAF spring rise preclude
  - No proration
- MBIO53
  - 5 kcfs first rise
  - Alternative April guide curves
  - Minimal increase of flood control constraints
  - 31 MAF spring rise preclude
  - Proration

42

Table 3

Table 3. Current flood control constraint flow values in kcfs and low-increase option for constraints.

	Flow Target for Service Level of 35 (Full Service)	Current Flood Control Target (Reduce to Full Service)	Current Flood Control Target (Reduce to Min. Service)	Low increase for Spring Rise FC Target (Reduce to Full Service)	Low increase for Spring Rise FC Target (Reduce to Min. Service)
Sioux City	31				
Omaha	31	41	46	49	50
Nebraska City	37	47	57	55	57
Kansas City	41	71	101	75	93

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Table 1

Table 1. Criteria Provide by the technical work group for alternative formulation.

Criteria	Values to be Modeled		
1st Rise	No rise	Nav. +5 kcfs for 1 wk	Nav. +5 kcfs for 1 wk
Drop between rises	Min. Service	Alternative Guide Curve	MM Guide Curve
2nd Rise – Max.	16 kcfs for 2 wks		
2nd Rise – FC Constraints	Plus 16 to MM	Min change from MM	
Max or Prorate During Drought	Maximum with preclude	Prorate with Preclude	

Figure 14

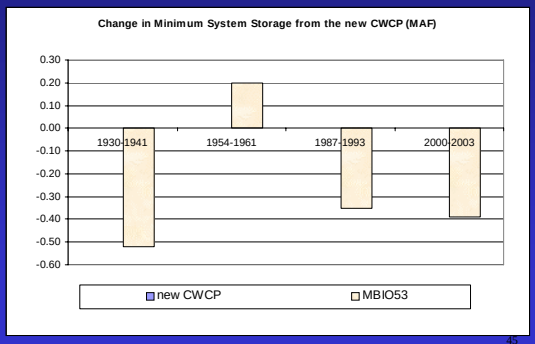


Figure 15

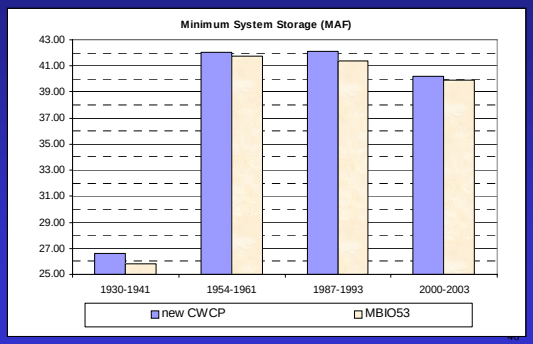


Figure 16

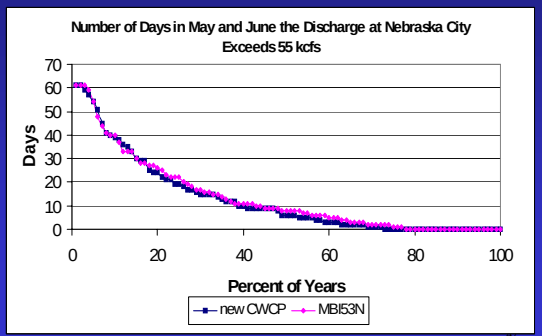
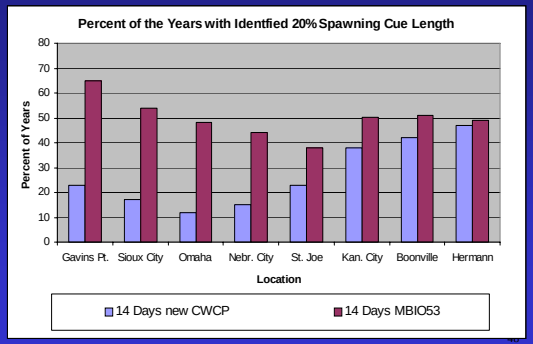


Figure 17



First Bimodal Rise Downstream Crop Damage Risk

- 31-kcfs rise is not predominant in many years when compared to normal releases under the new Water Control Plan; therefore, crop damage risk is relatively unchanged.
- Higher magnitude rises will increase crop damage risk.
- Having the rise start earlier at the 31-kcfs level may increase the crop damage risk as the release during that earlier period could be as much as 15 to 22 kcfs higher than under the new Water Control Plan.

49

Service Level between Rises Frequency of Rise

- Variable, depending on location on the Lower River.

50

Service Level between Rises Drought Storage Levels

- The higher the service level during this period, the lower the storage levels in the droughts. This effect is true primarily due to the lost storage in the first year of the drought due to the one month of increased service. In subsequent years of the drought, the service levels are almost always minimum service due to the relatively higher guide curves of the new Water Control Plan for this period of the year.
- Service levels lower than minimum service will not reduce storage levels as much as the minimum service alternatives.

51

Service Level between Rises Downstream Crop Damage Risk

- The higher the service level in this period, the higher the crop damage risk in this period and during the second spring rise as its release rate is based on the service level flow target requirements during the spring rise.

52

Second Bimodal Rise Frequency of Rise

- Assuming the magnitude continues to be based on 16-kcfs rise, the frequency of the rises can be affected by the drought stop protocols and the downstream flood control constraints.
- As the drought stop protocols limit rises during droughts, the frequency of rises may be diminished.
- As the flood control constraints are not raised as much to accommodate the spring rise, the frequency of the spring rise is diminished.
- Increasing the duration of the spring rise should have little effect on the frequency of the rise.

53

Second Bimodal Rise Drought Storage Levels

- Assuming the magnitude continues to be based on 16-kcfs rise, the effects of the rises on drought storage levels can be affected by the drought stop protocols and the downstream flood control constraints.
- As the drought stop protocols limit rises during droughts, the drought storage levels will be increased.
- As the flood control constraints are not raised as much to accommodate the spring rise, the drought storage levels will be increased.
- Increasing the duration of the rise will further reduce drought storage levels.

54

Second Bimodal Rise Downstream Crop Damage Risk

- Assuming the magnitude continues to be based on 16-kcfs rise, the effect of the rises on downstream flood risk can be affected by the drought stop protocols and the downstream flood control constraints.
- As the drought stop protocols limit rises during droughts, the downstream flood risk will be diminished very minimally.
- As the flood control constraints are not raised as much to accommodate the spring rise, the downstream crop damage risk is diminished.
- Increasing the duration of the spring rise should increase the crop damage risk.

55

Attachment C
Tribal Water Intake Presentation
By Col. Bedey

Spring Rise Plenary Meeting

29 June 2005

Bismarck, North Dakota

US Army Corps of Engineers
Omaha District

Drought Expenditures - FY 2004

State	Lake	Water Intake	Boat Ramps	Cultural Resource Protection	Noxious Weeds	Total Costs by State
Montana	Ft. Peck Lake	$0	$150,000	$0	$0	$150,000
North Dakota	Lake Sakakawea	$0 1)	$100,000 2)	$25,000	$250,000	$375,000
South Dakota	Lake Oahe	$0	$50,000	$275,000	$150,000	$475,000
Total cost by item:		$0	$300,000	$300,000	$400,000	$1,000,000

Drought Expenditures - FY 2005 (Expected)

Montana	Ft. Peck Lake	$0	$450,000	$20,000	$40,000	$510,000
North Dakota	Lake Sakakawea	$100,000	$195,000 6)	$45,000	$560,000	$900,000
South Dakota	Lake Oahe	$60,000	$0	$635,000	$300,000	$995,000
Total cost by item:		$160,000 3), 4), 5)	$645,000	$700,000	$900,000	$2,405,000

1) $3,000,000 Parshall water intake not included
2) $100,000 Congressional add for ramps not included
3) $50K Ft. Yates, 30K Parshall, 20K Mni Waste', 20K Mandaree, 20K each Wakpala, Oacoma
4) Does not include $600,000 received in FCCE funding for Mni Waste' Phase 1
5) Does not include $250,000 received in FCCE funding for Basin Water intake study
6) $625K Congressional add for ramps not included, also $300K for Ft Stevenson not included

Municipal Intakes on the Missouri River Main Stem Reservoirs

Intake	Population Served	Responsible Agency
Garrison Reservoir		
Whiteshield	720	TAT/BOR
Twin Buttes	425	TAT/BOR
Mandaree	780	TAT/BOR
Four Bears	900	TAT/BOR
Parshall		City of Parshall
Pick City		City of Pick City
City of Garrison	2000	City of Garrison

Intake	Population Served	Responsible Agency
Ft. Randall Reservoir		
City of Chamberlain	5,000	City of Chamberlain
Aurora-Brule RWS		Aurora-Brule RWS
Town of Oacoma	390	Town of Oacoma
Randall Community Water Dist. – Platte		Randall Comm. Water Dist
Randall Community Water Dist. – Pickstown		Randall Comm. Water Dist

Oahe Reservoir		
Ft. Yates	3,400	SRST/BOR
Wakpala	>500	SRST/BOR
Mni Wasté	14,000	CRST

Gavins Point Reservoir		
City of Springfield	1,600	City of Springfield
Cedar Knox Rural Water Project	3,400	Cedar Knox Rural Water Project
B-Y RWS Intake 1	4,000 (both intakes)	B-Y RWS
B-Y RWS Intake 2	4,000 (both intakes)	B-Y RWS

Big Bend Reservoir		
Lower Brule RWSS	1,350	Lower Brule RWSS/BOR
Ft. Thompson – Crow Creek RWS	2,800	Crow Creek Sioux Tribe
Mid-Dakota Rural Water	30,000	Mid-Dakota Rural Water

Omaha District Drought Report

PROJECT: **Garrison, North Dakota** DATE: 27-Jun-2005

Reservoir Elevation Overview:

		30-Day	60-Day	180-Day
5/30/2005	6/27/2005	6/30/2005	7/31/2005	11/30/2005
	Current Lake Elevation (ft. msl)	Projected Elevation (ft. msl)	Projected Elevation (ft. msl)	Projected Elevation (ft. msl)
1808.08	1813.48	1807.6	1804.5	1802.4

Comments:

1. Current reservoir elevation 25.38 ft. below top of conservation pool.
2. Projections based upon Lower Basic Simulation prepared by RCC.
3. Consistent rainfall in early- to mid-June has caused flooding in 10 North Dakota counties including Sioux County and McLean County, which lie adjacent to the Missouri River.
4. June and July runoff predicted to be well below normal.
5. Recent rains have caused a 5.4 ft. rise in reservoir elevation since May 31, 2005.

Omaha District Drought Report

PROJECT: Garrison, North Dakota	DATE: 27-Jun-2005

Water Intake Overview:

Intake	Status	Current Reservoir Elev.	Top of Screen Elev.	Operational Concern Elev.	Shutdown Elev.		Population Supported	Contingency Plan? (Y/N)	Responsible Agency
					Summer	Winter			
Whiteshield	Operational	1813.48	1787	1812	1792	1792	720	N	TAT/BOR

Comments:
1. The intake screen has been raised approximately 4 feet.
2. Rock from the adjacent shoreline was used to stabilize the shoreline near the intake.
3. An additional 375 cy of rock is being hauled in by the operator to stabilize the shoreline from the water's edge to the high water line.

Future Plans:
1. Ft. Berthold Rural Water System is seeking funding through USDA Emergency Community Water Assistance Grant Program for:
   a. Exploration and mapping of the intake area.
   b. Extending approx. 400 to 500 feet from the current intake screen with 8" to 12" casing pipe. The new intake screen elevation would be approx. 1780 (or lower).
   c. Esimated cost: $1.16 million
   d. Estimated time of completion: Late 2005/Early 2006

Omaha District Drought Report

Intake	Status	Current Reservoir Elev.	Top of Screen Elev.	Operational Concern Elev.	Shutdown Elev.		Population Supported	Contingency Plan? (Y/N)	Responsible Agency
					Summer	Winter			
Twin Buttes	Operational	1813.48	1786	1810	1790	1790	425	N	TAT/BOR

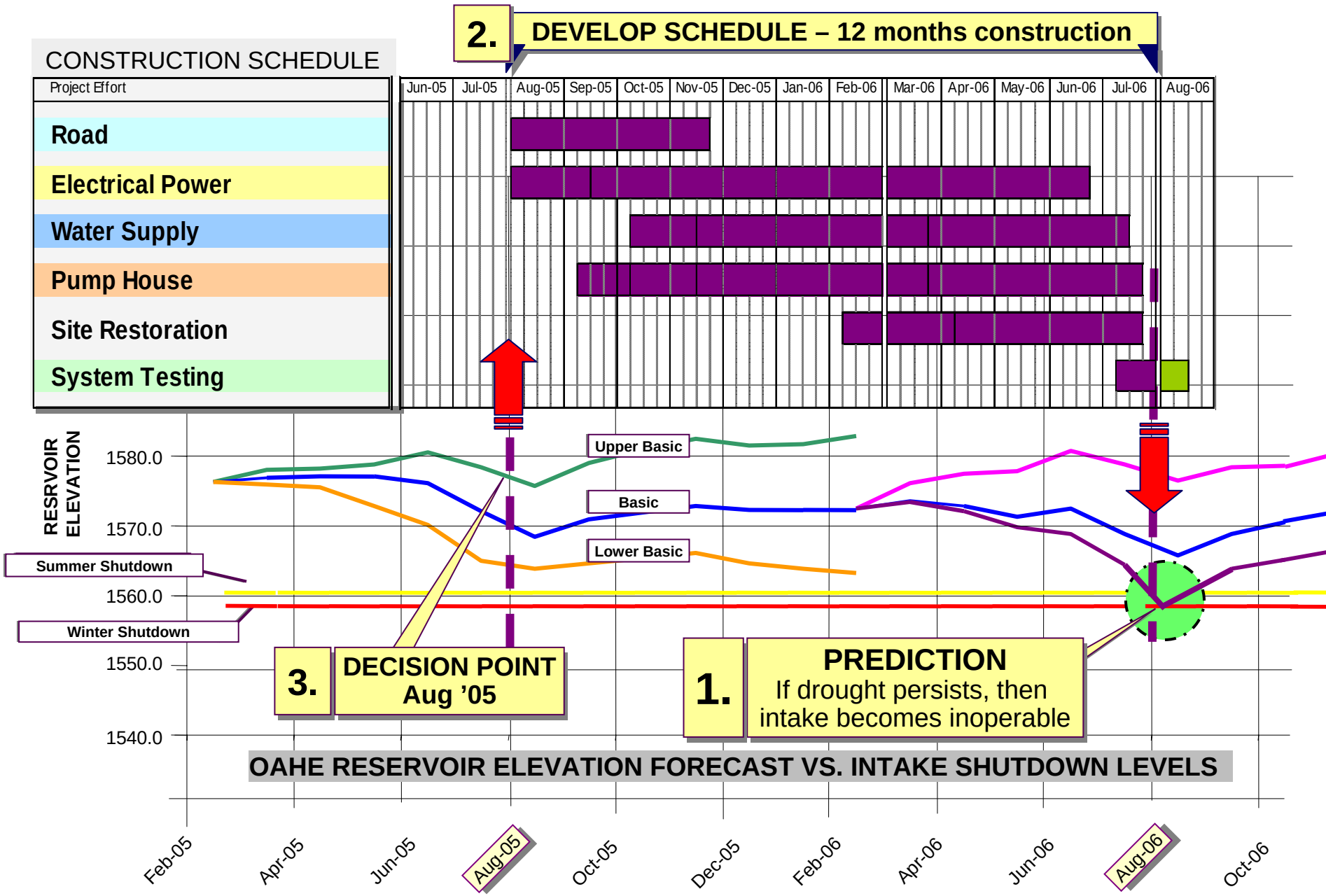
Comments:
1. The current intalke line consists of 2-8" lines, one line tees into the other.
2. Two submersible pumps are located in the lines. One pump is inoperable and is being repaired.

Future Plans:
1. Ft. Berthold Rural Water System is seeking funding through USDA Emergency Community Water Assistance Grant Program to extend and lower the existing intake line and screen. Their plans are to:
   a. Install a new casting approx. 450 feet into the lake.
   b. Install a new 10" to 12" supply line, approx. 300' to 400' beyond the current location to approx. elev. 1780.
   c. Bank stabilization and erosion control over new line.
2. The Corps is currently staffing a request from FBRWS to amend existing waterline ROW.

Intake	Status	Current Reservoir Elev.	Top of Screen Elev.	Operational Concern Elev.	Shutdown Elev.		Population Supported	Contingency Plan? (Y/N)	Responsible Agency
					Summer	Winter			
Mandaree	Operational	1813.48	1795	1811	1791	1791	780	N	TAT/BOR

Comments:
1. Bartlett & West has awarded a contrct to install a new intake at Mandaree.
2. The new intake will lower the screen to elev. 1786.
3. The work should be complete by July 2005.
4. The project will include directional drilling.
5. Grant monies for the work was secured from USDA Rural Utilities Servie and Indian Health Services.

TRIGGER POINT DECISION PROCESS



Questions?

Attachment D
USGS Presentation
By David Galat and Robb Jacobson

When Do Pallid Sturgeon Spawn?

Information Sources:
Pat Braaten, USGS
Herb Bollig USFWS
Aaron Delonay USGS
Wyatt Doyle, USFWS
Dave Herzog, MDC
Rob Holm, FWS
Diana Papoulias, USGS
Kerry Reeves, U of MO
Darrel Snyder, CSU

Presenter:
David Galat
USGS, Cooperative Research Units
Department of Fisheries & Wildlife Sciences
University of Missouri, Columbia, MO
galatd@missouri.edu

INFORMATION NEEDS TO DESIGN GPD FLOW RELEASE

When & Where do Pallid Sturgeon Spawn?

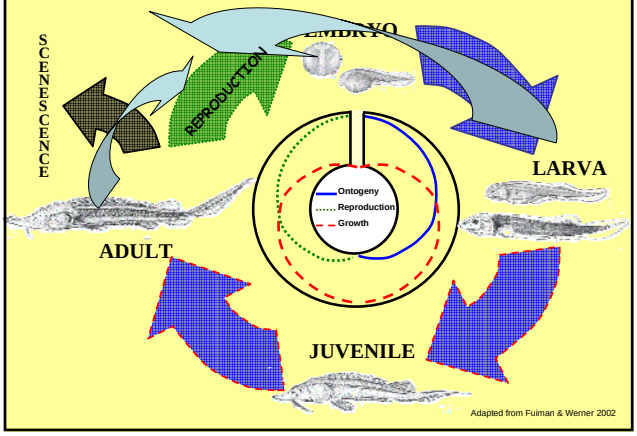
When do *Scaphirhynchus* Sturgeon Spawn?

INFORMATION NEEDS TO DESIGN GPD FLOW RELEASE

What Environmental Conditions Control *Scaphirhyncus* Spawning?

What GP Dam Flow Releases will Most Benefit Pallid Sturgeon Reproduction & Meet Other System Needs?

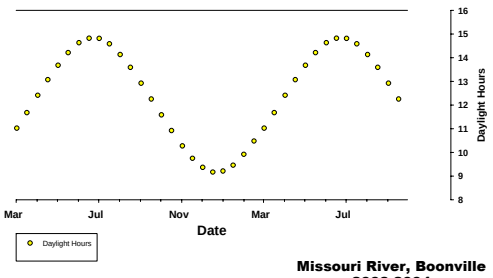
GENERALIZED *SCAPHIRHYNCHUS* LIFE STAGES



Environmental Factors Affecting Successful Sturgeon Spawning

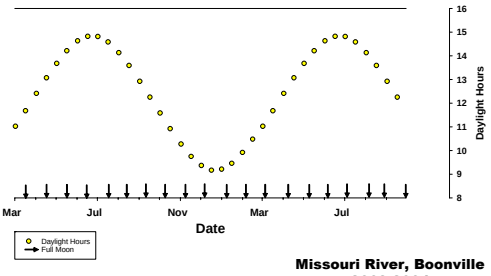
- Photoperiod
- Lunar Cycle
- Temperature
- River Flow

Environmental Factors Affecting Successful Sturgeon Reproduction
PHOTOPERIOD



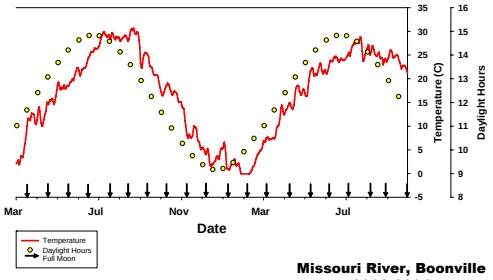
Missouri River, Boonville
2003-2004

Environmental Factors Affecting Successful Sturgeon Reproduction
PHOTOPERIOD + LUNAR CYCLE



Missouri River, Boonville
2003-2004

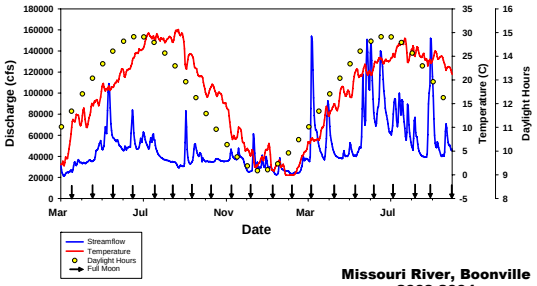
Environmental Factors Affecting Successful Sturgeon Reproduction
PHOTOPERIOD + LUNAR CYCLE + TEMPERATURE



Missouri River, Boonville
2003-2004

Environmental Factors Affecting Successful Sturgeon Reproduction

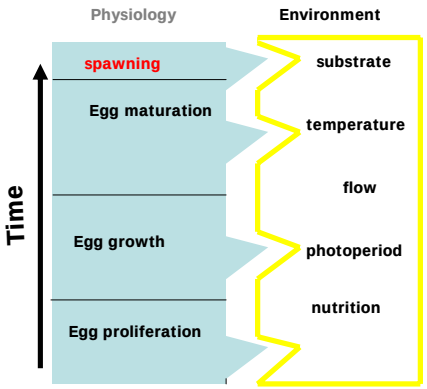
PHOTOPERIOD + LUNAR CYCLE + TEMPERATURE + RIVER FLOW



Missouri River, Boonville 2003-2004

Biotic Factors Affecting Successful Sturgeon Spawning

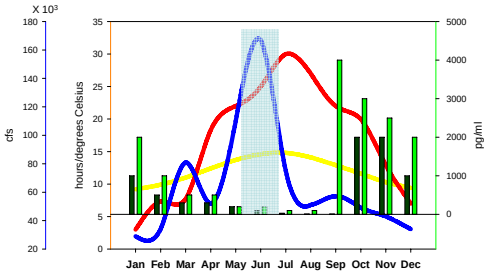
- Age
- Condition
- Physiological State
- Behavioral (Social) Cues



USGS

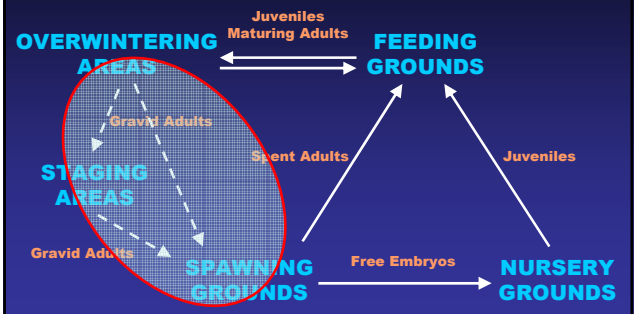
Source: D. Papoulias, USGS-CERC

Environmental Variables Relative to Reproductive Indicators



Source: D. Papoulias, USGS-CERC

Dynamic Model of Possible *Scaphirhynchus* Habitat Use by Life Stage & Associated Migration Cycles



How do we know when sturgeon spawn?

- Observe spawning
- Track reproductively mature instrumented fish
- Ovarian development
- Collect larvae

Ovarian Development

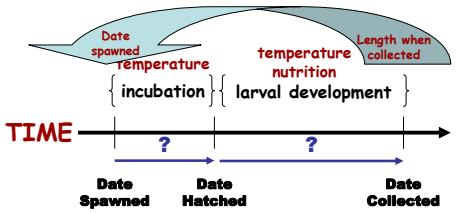
Ripe Female – black eggs

Recently Spawned Female – spent

Source: D. Papoulias, USGS-CERC

When a larval sturgeon is collected versus when its mom spawned

~17 days or 292 cumulative thermal units



~7 days @ 16 °C or 112 cumulative thermal units

~10 days @ 18 °C or 180 cumulative thermal units

Important Developmental Events for Larval Pallid Sturgeon

Source: Snyder J. Appl. Ichthyol. 2002

Free Embryo 8-9 mm TL, 0 D

Protolarvae

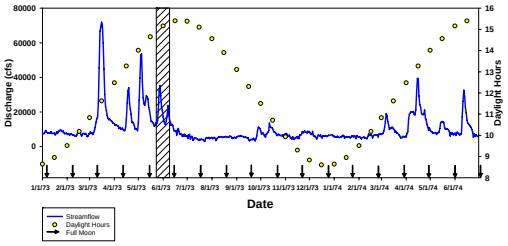
Yolk Absorbed 18-19 mm TL, ~12 D

Mesolarva ~25 mm TL, ~21 D

Metalarvae 82-138 mm, 54-92 D

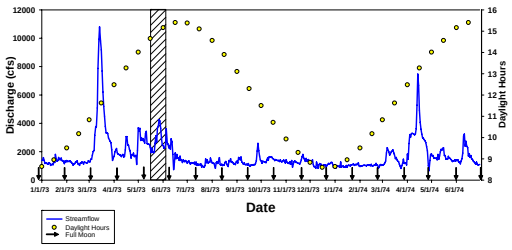
Estimated Spawning Period for Shovelnose Sturgeon in a Non-flow Regulated River

Christenson - Chippewa River, WI

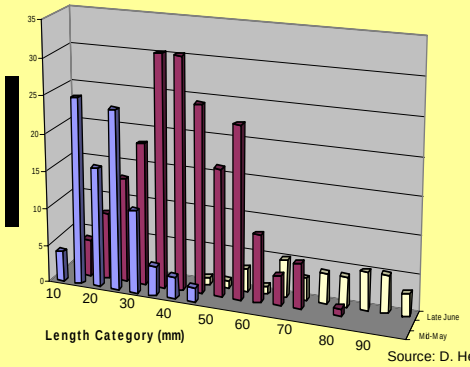


Estimated Spawning Period for Shovelnose Sturgeon in a Non-flow Regulated River

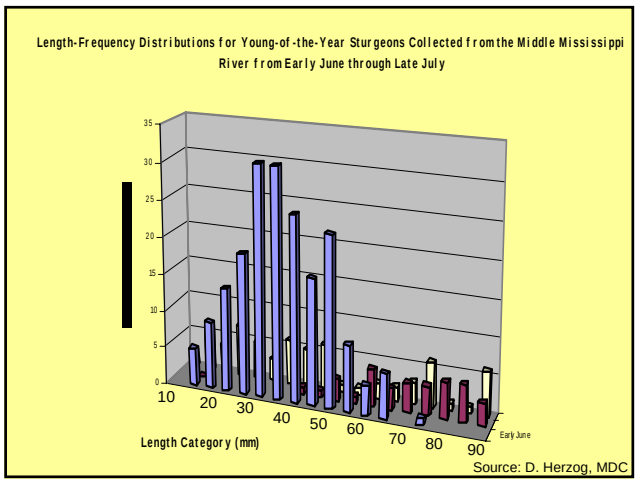
Christenson - Red Cedar River, WI

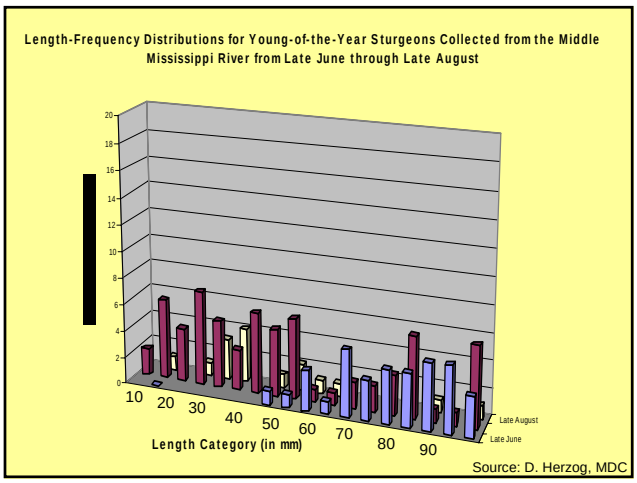


Length-Frequency Distributions for Young-of-the-Year Sturgeons Collected from the Middle Mississippi River from Mid-May through Late-June

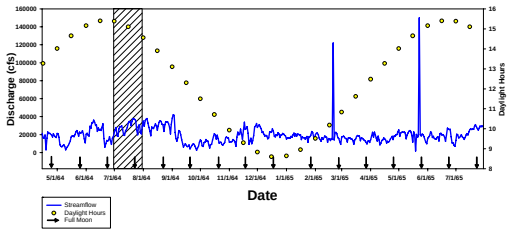


Source: D. Herzog, MDC



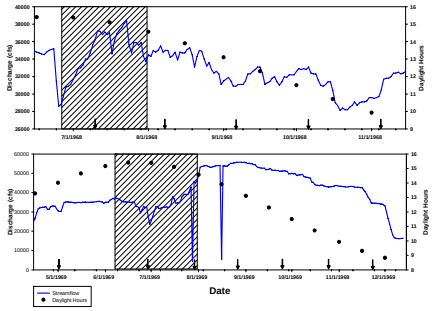


June – MOR, Pierre, SD, 15 April 1964 – 30 July 1965



June, F. C. Env. Biol. Fish. 2: 285-296, 1977

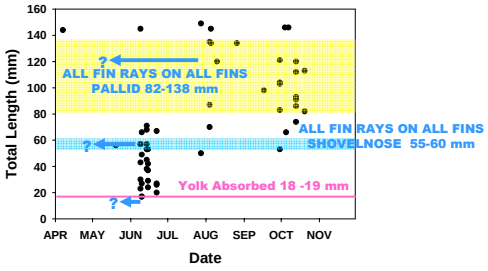
Moos – MOR, Yankton, SD, 1968 – 1969



Moos, R. E. PhD Dissertation, U. of SD, 1978

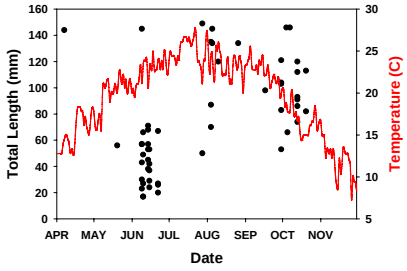
Length-Frequency Distributions for YOY Scaphirhynchus Sturgeons, Lower Missouri River, MO
USFWS Columbia Fisheries

2004



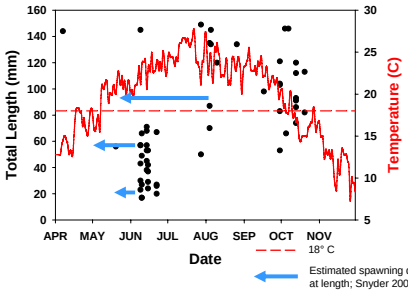
Length-Frequency Distributions for YOY Scaphirhynchus Sturgeons, Lower Missouri River, MO
USFWS Columbia Fisheries

2004



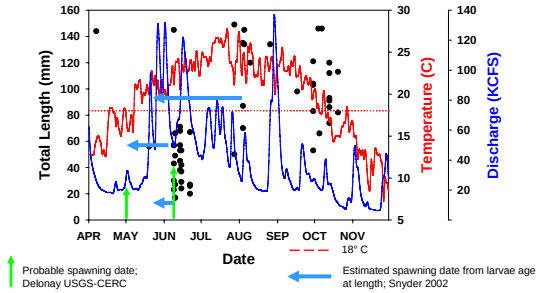
Length-Frequency Distributions for YOY Scaphirhynchus Sturgeons, Lower Missouri River, MO
USFWS Columbia Fisheries

2004

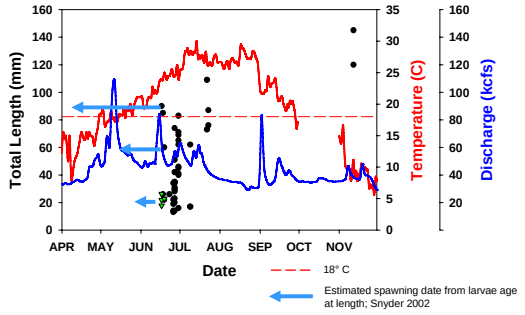


Length-Frequency Distributions for YOY Scaphirhynchus Sturgeons, Lower Missouri River, MO
USFWS Columbia Fisheries

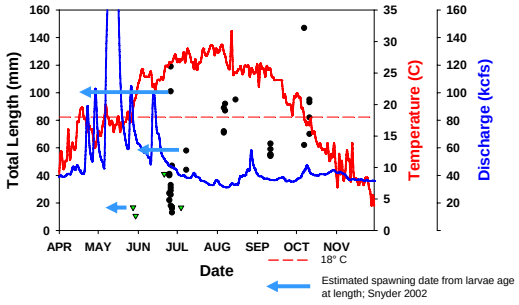
2004



Length-Frequency Distributions for YOY Scaphirhynchus Sturgeons, Lower Missouri River, MO
USFWS Columbia Fisheries – K. Reeves UMC
2003

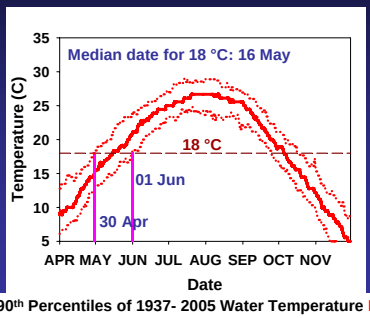


Length-Frequency Distributions for YOY Scaphirhynchus Sturgeons, Lower Missouri River, MO
USFWS Columbia Fisheries – K. Reeves UMC
2002



What we know about *Scaphirhynchus* spawning

- **~18 °C when spawning begins in lower Missouri River, Missouri**



10th , 50th, 90th Percentiles of 1937- 2005 Water Temperature Boonville, MO

What we know about *Scaphirhynchus* (largely shovelnose) spawning in LMOR

Observations:

- **Mature females, black eggs, high GSI occur from March – August**
- **Duration of larvae <60 mm TL Apr – Oct**
- **No larvae collected at water temperature <18°C**

Conclusions:

- **Spawning does begin before June rise**
- **Spawning may not be flow dependent, but successful reproduction might be**
- **Scaphirhyncus population has a protracted spawning period**

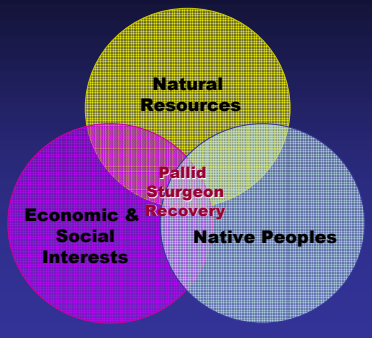
Uncertainties
When do pallid sturgeon spawn?

- No empirical evidence as of today of when or where pallid or shovelnose sturgeon actually spawn
- Sturgeon responses observed in highly altered Missouri River many not be normative or adaptive
- Information reported here is largely for lower Missouri River in MO, does it apply elsewhere?
- We cannot accurately separate shovelnose & pallid sturgeon larvae to refine role of flow & temperature in spawning by each species
- Is the shovelnose sturgeon an accurate surrogate for pallid sturgeon reproduction?

Uncertainties
When do pallid sturgeon spawn?

- How do flow & temperature & interact spatially to affect spawning? - longitudinal, lateral w/in main channel, main channel vs. tributaries
- How do flow & temperature & interact temporally to affect spawning? - w/in season, w/in year, among years
- How long does it take from spawn to hatch for sturgeon eggs at various river temperatures?
- What is the growth (Δ in TL) per day for sturgeon larvae from hatch to juvenile over a range of temperatures and food rations?
- How far do larval sturgeon disperse downriver before they settle or are collected?

Adaptive Problem Solving



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science for a changing world

Hydrograph Design, Lower Missouri River

- Hydrologic variation, space and time
- Functions of the hydrograph
- A design approach

Robert B. Jacobson
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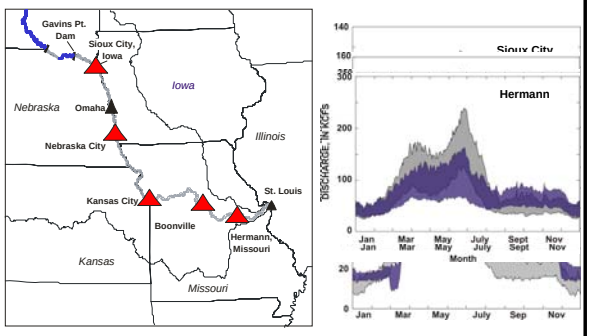
Lower Missouri Flow-Regime Gradient



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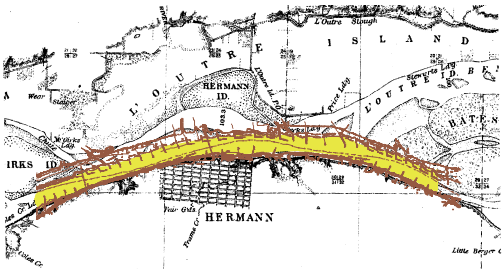
Changes in Channel Form

- *Historical reference conditions*



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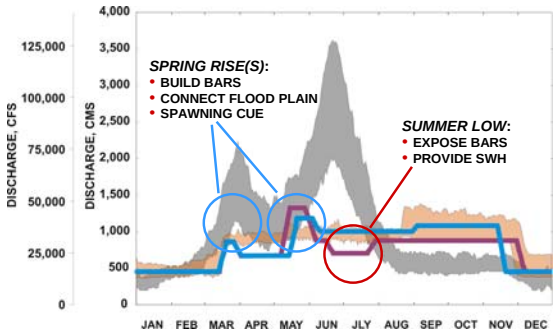
Lower Missouri Flow-Regime



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Functions of the Hydrograph

Summer Low

Hypothesized Role

Expose sand bars

Provide shallow-water habitat for young fish

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Functions of the Hydrograph

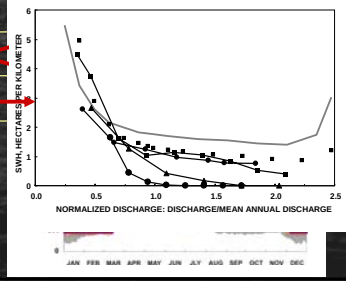
Spring Rise:

Hypothesized Role

Build sand bars

Connect flood plain

Spawning cue



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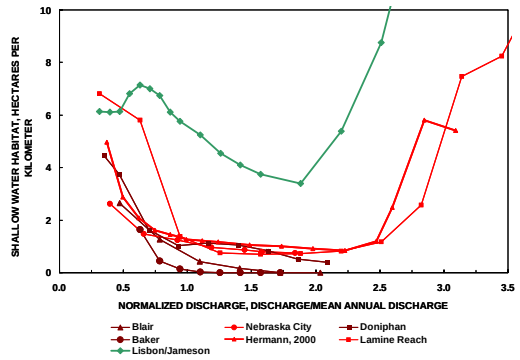
Functions of the Hydrograph - Connectivity



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Functions of the Hydrograph

Spring Rise:

Hypothesized Role
Build sand bars
Connect flood plain
Spawning cue

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Engineering the Hydrograph

Two approaches to designing hydrograph attributes:

- *Specific biological information*
- *Historical hydrograph*

Use sparse biologic data to constrain design; then use reference hydrograph to define range of flows characteristics.

Tools:

- *Daily routing model for hydrologic scenarios*
- *Hydrograph analysis – IHA approach*

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Hydrologic Scenarios

USACE Daily Routing Model

- *100 years of daily data, entire basin*
- *Routed to downstream gage sites*
- *Standard of analysis for Missouri River management*

- *Critical for analysis and management.*
- *Not easily used by stakeholders*

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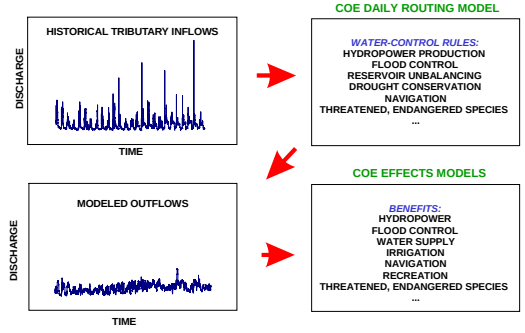
Corps of Engineers Missouri River Daily Routing Model*



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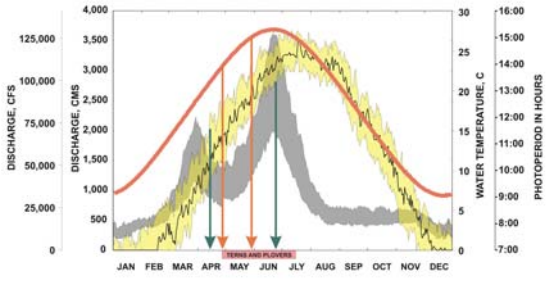
* Roy McAllister, COE

Estimates of Sturgeon Spawning Window



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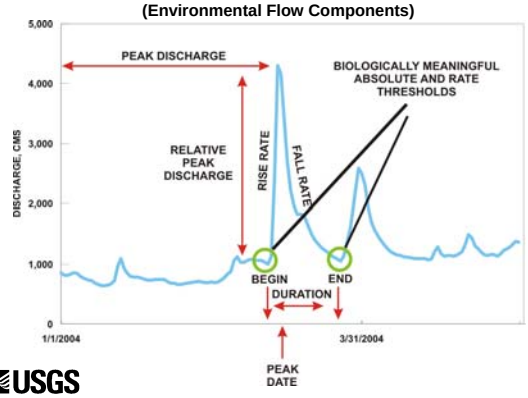
Parsing the Hydrograph for Ecological Meaning

(Environmental Flow Components)



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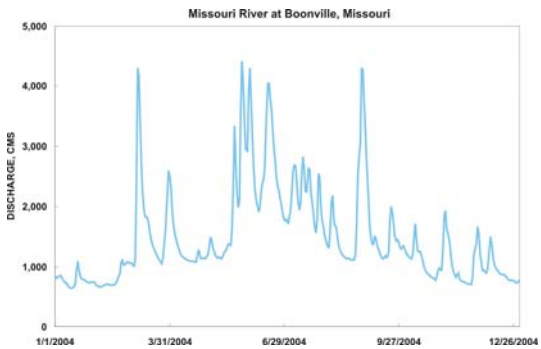
Parsing the Hydrograph



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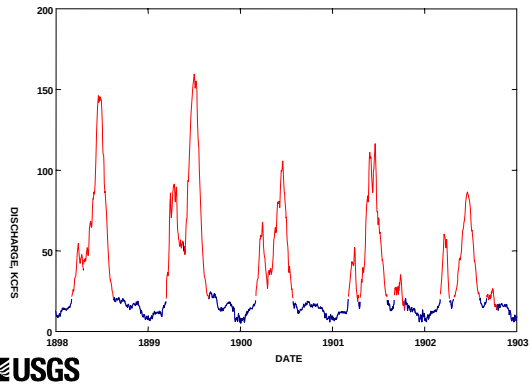
Parsing the Hydrograph



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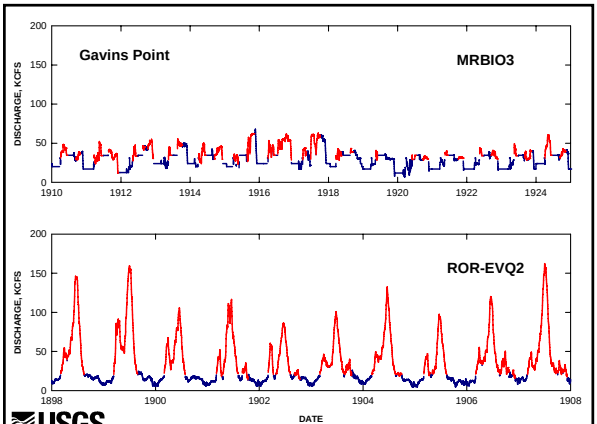

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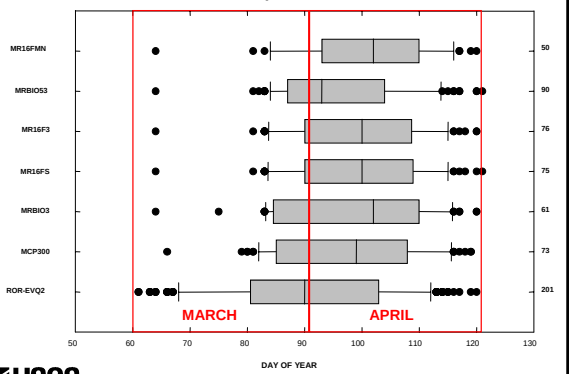
Environmental Flow Components – GAPT – First Peak



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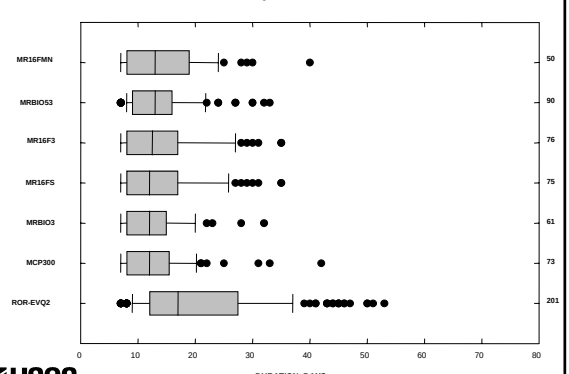
Environmental Flow Components – GAPT – First Peak



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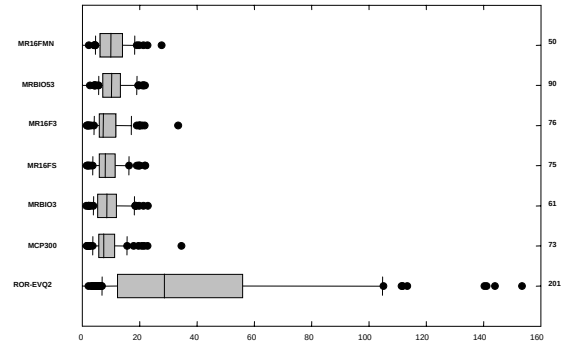
Environmental Flow Components – GAPT – First Peak



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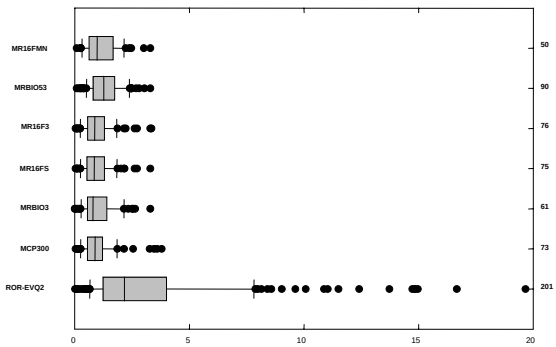

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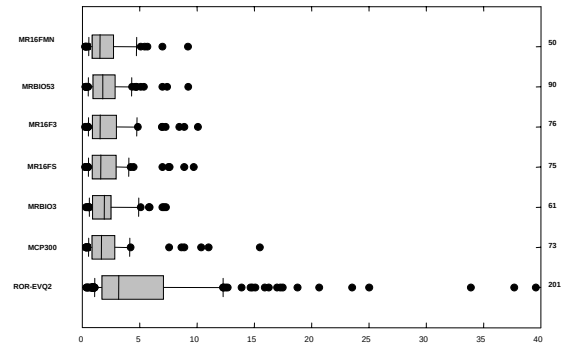
Environmental Flow Components – GAPT – First Peak



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Some Questions

- *Biological design criteria*
  - *Rise for migration, spawning, dispersal?*
  - *Spawning on rise, or declining limb?*
  - *Spawning substrate conditioning?*
  - *Single or double SR?*
  - *Durations, peak or plateau?*
  - *Rates of rise and fall?*
- *SR design for information content & recovery?*

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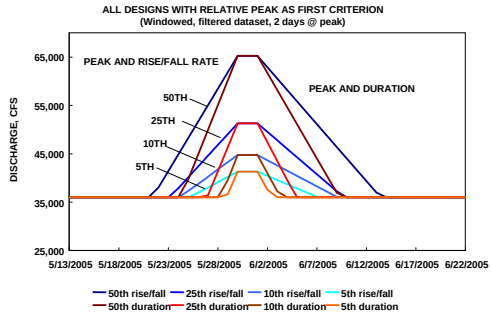
Design Based on ROR Hydrograph



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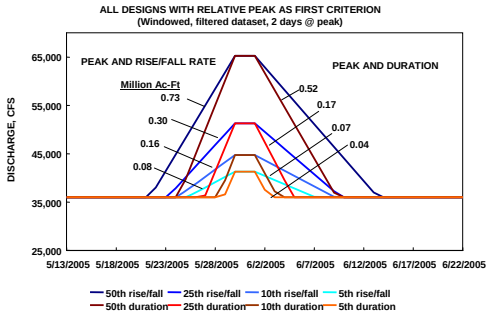
Design Based on ROR Hydrograph



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